

SERVICE MANUAL
MODEL PLUS 4 COMPUTER
OCT. 1984 PN-314001-04

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PLUS 4 PRODUCT SPECIFICATION

MEMORY

64K RAM. 60K RAM User accessible for BASIC programs.

ROM

32K ROM Standard (includes operating system and BASIC interpreter) with 32K additional ROM containing the built-in productivity software.

MICROPROCESSOR

7501 Microprocessor — .89 or 1.76 MHz clock.

DISPLAY

40 Columns x 25 lines of text.

COLORS

128 Colors (16 colors; 8 luminance levels).

CHARACTERS

Upper & lower case letters, numerals and symbols. Reverse and flashing characters. All PET graphic characters.

DISPLAY MODES

Text characters. High resolution graphics. Split screen text/high resolution graphics. Multicolor graphics.

RESOLUTION

320 x 200 Pixels

SOUND

2 Tone generators or 1 Tone and 1 white noise generator.

VOLUME

8 Volume levels

KEYBOARD

Full size typewriter style design

KEYS

67 Keys total. 4 Cursor control keys. 4 Programmed (reprogrammable) function keys (up to 8 user defined functions possible). Color control keys. HELP key. Upper and lower case character set. Graphics character set.

INPUTS/OUTPUTS

PLUS/4 MODEM (User) port. Serial port. ROM cartridge and parallel disk drive port. 2 Joystick ports. C1531 Cassette drive interface port. RF Output-channel 3 or 4. Video output-composite/chrominance/luminance. Audio input/output. Power supply input.

PLUS 4 PRODUCT SPECIFICATION (Continued)

FEATURES

Built-in extended BASIC 3.5 — over 75 commands. Built-in Machine Language monitor — over 12 commands. Built-in graphics and sound commands. Screen window capability. Reset button (Warm start). Built-in integrated productivity software.

PERIPHERALS

C1551 Fast Disk drive, C1531 Datasette, MPS 802 Dot matrix printer, MPS 803 Dot matrix printer, DPS 1101 Daisy wheel printer, C1802 color monitor.

OTHER PERIPHERALS

C1541 Disk drive, MPS 801 Dot matrix printer, C1702 color monitor.

PLUS 4 OVERVIEW

The Plus 4 system is based on the 7501 microprocessor, an HMOS version of the 6510. Video processing is achieved by the 7360 TED chip. 64K bytes of dynamic RAM are accomplished by 8 (64K x 1) I.C.'s. (See page). The system program is contained in 2 (16K x 8) ROMs. The system supports up to 128K x 8 of ROM banked in 16K sections. By software control, through the 7360, ROM can be completely banked out and RAM banked in for a true 64K of RAM (minus 256 byte pages), allowing 60,671 bytes available for BASIC.

Keyboard and joystick scanning are accomplished by outputting the row data on the data bus while addressing a particular register in the TED chip. This will in turn cause the TED chip to latch the column information.

A standard serial port supports serial bus peripherals such as the 1541 disk drive and the various serial printers. A cassette port is provided and the expansion port supports ROM cartrdiges. TTL serial ASCII is intended to drive an RS-232 adapter.

**PARTS LIST
PLUS/4**

TOP CASE ASSY

| | |
|-------------------------|-------------|
| Top Case | C 251453-01 |
| Keyboard, 67 Key, KKR-I | C 251501-01 |
| Nameplate | C 251655-01 |
| Shield Clip, R | C 251855-01 |
| Shield Clip, F | C 251856-01 |

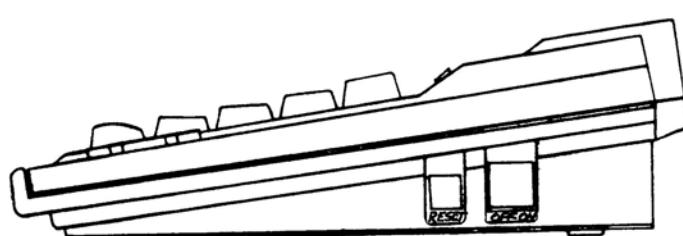
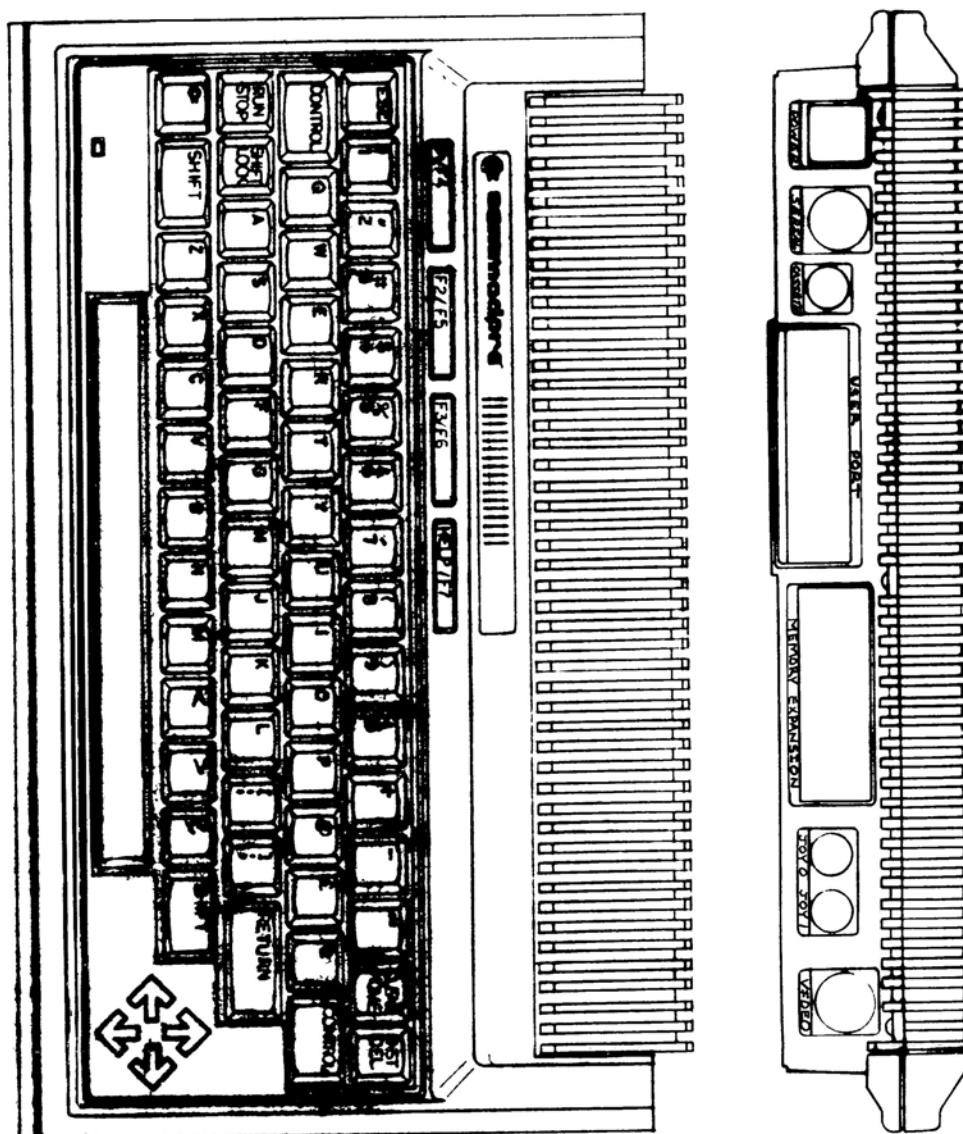
BOTTOM CASE ASSY

| | |
|---------------------|-------------|
| Bottom Case | C 251454-01 |
| Foot, Self-Adhesive | C 950157-04 |
| Paper Shield | C 310156-01 |
| Shield Chip | C 310199-01 |
| Shield Plate | C 310197-01 |
| Insulation Sheet | C 310198-01 |

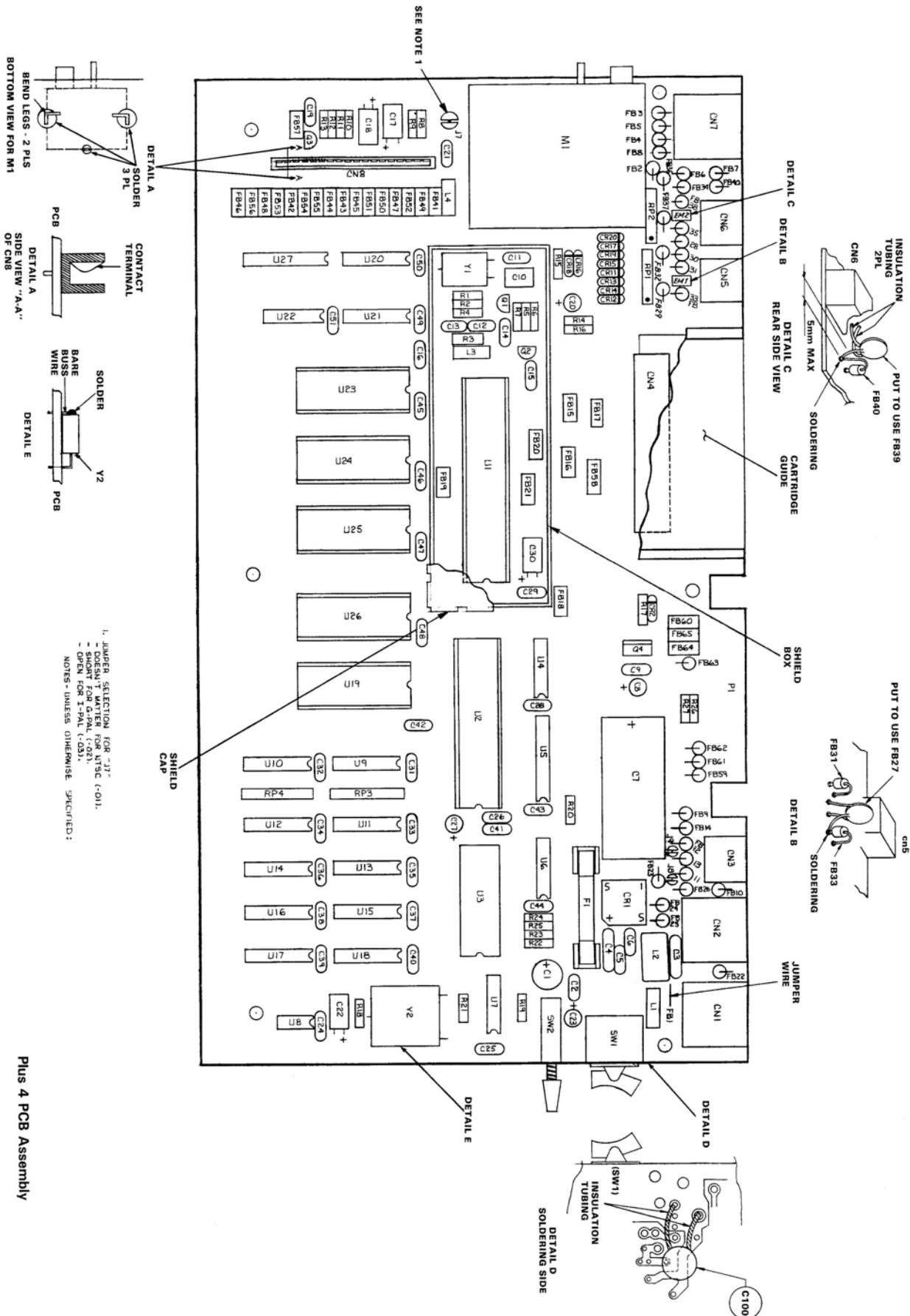
ACCESSORIES

| | |
|--------------|-------------|
| Users Manual | C 310196-01 |
| Power Supply | C 310157 |
| RF Cable | C 326189-02 |
| Switch Box | C 904778-01 |

C — Commodore Stock Part



Plus 4 Casing Identification



Plus 4 PCB Assembly

PARTS LIST — PLUS/4 PCB ASSEMBLY #310163-01

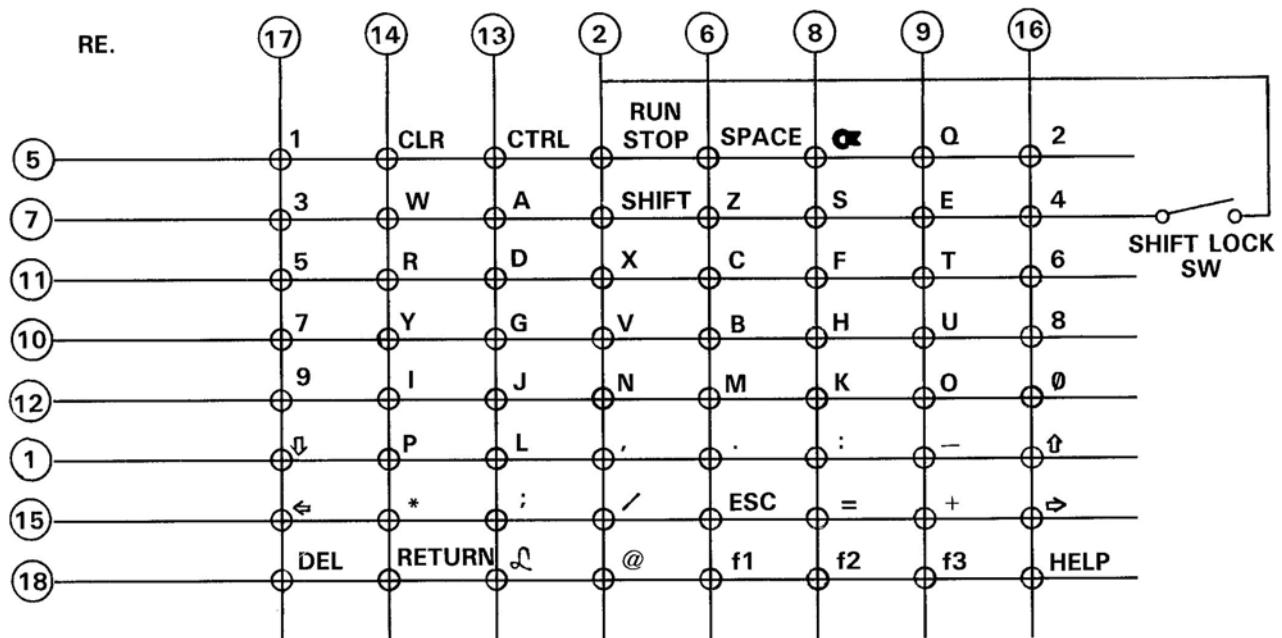
PLEASE NOTE: Commodore part numbers are provided for reference only and do not indicate the availability of parts from Commodore. Industry standard parts (Resistors, Capacitors, Connectors) should be secured locally. Approved cross-references for TTL chips, Transistors, etc. will be available in manual form through the Service Department in November of 1984. Unique or non-standard parts will be stocked by Commodore and are indicated on the parts list by a "C".

| INTEGRATED CIRCUITS | | DIODES (Continued) | |
|----------------------------|--|---|---|
| U1 | 7360 VLSI, Text Display (TED) Sub: 8360 | C 251535-01 C 251535-02 | CR1 (cont.) |
| U2 | 7501 Custom Microprocessor | C 251536-01 | CR2 CR11-20 |
| U3 | 6551A (Synertek) | 901895-02 | Bridge Rectifiers DBA20C Sanyo 251026-03 |
| U4 | 74LS08 | 901521-03 | Diode, Zener RD 6.8 EB 900927-01 |
| U5 | 6529B Single Port Interface | C 251640-03 | Diode, IN 914 Sub: 900850-16 |
| U6 | 74LS04 | 901521-02 | Diode, IN 4148 Taping 251819-21 Sub: |
| U7 | 7406 | 901522-06 | Diode, IN 4148 900850-01 |
| U8 | 555 | 901523-01 | |
| U9-10 | 74LS257 | 901521-57 | |
| U11-18 | 4164-2 D-RAM | 901505-01 | |
| U19 | 7700-010 PLA | C 251641-02 | |
| U20 | 74LS139 | 901521-18 | |
| U21 | 74LS175 | 901521-34 | |
| U22 | 74LS27 | 901521-22 | |
| U23 | 2312B ROM TED Basic | C 318006-01 | |
| U24 | 23128 ROM TED Kernel | C 318005-04 | |
| U25 | 23128 FUNCTION ROM, 3+1 LOW | C 317053-01 | |
| U26 | 23128 FUNCTION ROM, 3+HIGH | C 317054-01 | |
| U27 | 6529B Single Port Interface | C 251640-03 | |
| TRANSISTORS | | RESISTORS — All values are in ohms-1/4 W 5% unless noted otherwise. | |
| Q1-Q3 | 2SC 1815 | 902693-01 | R1 4.7K |
| Q4 | 2SD 880 | 902694-01 Sub: | R2 10K |
| | Tip 29A | 902653-01 Sub: | R3 470K |
| | 2SD 1266 | 902694-04 | R4 220K |
| | | | R5 18K |
| | | | R6 1.5K |
| | | | R7 470K |
| | | | R8 100K |
| | | | R9 1K |
| | | | R10 1K |
| | | | R11 12K |
| | | | R12 10K |
| | | | R13 1K |
| DIODES | | RESISTOR PACK | |
| CR1 | Bridge Rectifiers S2VB10 Sindengen 215026-01 Sub: Bridge Rectifiers DBA20B Sanyo 251026-02 Sub: | RP1, 2 3.3K, 6 PIN RP3, 4 68, 8 PIN 4 ISOLATED | 902441-29 326149-06 |
| CAPACITORS | | CAPACITORS | |
| C1 | Elect | 0.1 μ F 25V | 900100-40 |
| C2 | Ceramic | 0.1 μ F 25V | 251075-06 |
| C3 | Film | 0.22 μ F 100V | 900150-11 |
| C4 | Film | 0.22 μ F 100V | 900150-11 |
| C5-C6 | Ceramic | 0.22 μ F 50V | 900022-01 |
| C7 | Elect | 2200 μ F 16V | 900101-33 |
| C8 | Elect | 10 μ F 16V | 900100-25 |
| C9 | Ceramic | 0.1 μ F 25V | 251075-06 |
| C10 | Trimmer | 40 pF | 251029-02 |
| C11 | Ceramic | 22 pF 50V | 251070-14 |

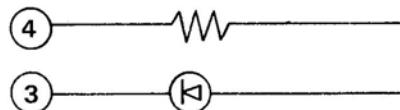
PARTS LIST – PLUS/4
PCB ASSEMBLY #310163-01 (Continued)

| CAPACITORS (Continued) | | | MISCELLANEOUS (Continued) | | |
|-------------------------------|---|-------------|----------------------------------|---|-------------|
| C12 | Ceramic 220 pF 50V Sub: 251071-26 Sub: | | FB2-14 | Ferrite bead | 325563-01 |
| C13 | Ceramic 220 pF 50V 900463-08 | | FB15-21 | Ferrite bead | 903025-01 |
| | Ceramic 150 pF 50V 251071-24 | | FB22-26, FB28-38, FB40 | Ferrite bead | 325563-01 |
| | Sub: | | FB41-58 | Ferrite bead | 903025-01 |
| C14 | Ceramic 150 pF 50V 900462-41 | | FB59 | Ferrite bead | 325563-01 |
| C15-C16 | Ceramic 0.1 μ F 25V 251075-01 | | FB60 | Ferrite bead | 903025-01 |
| C17-C18 | Ceramic 0.1 μ F 25V 251075-06 | | FB61-63 | Ferrite bead | 325563-01 |
| C19 | Ceramic 10 μ F 16V 900100-25 | | FB64-65 | Ferrite bead | 903025-01 |
| C20 | Ceramic 0.01 μ F 25V 251075-01 | | EM1,2 | EMI Filter | 251842-01 |
| C21 | Elect 10 μ F 16V 900100-25 | | CN1 | Connector 4 PIN (power supply) | |
| C22 | Ceramic 0.1 μ F 25V 251075-06 | | | | C 251614-01 |
| C23 | Elect 10 μ F 16V 900100-25 | | CN2 | Connector 6 PIN DIN (serial bus) | |
| C24-C26 | Ceramic 0.1 μ F 25V 251075-06 | | | | C 903361-01 |
| C27 | Elect 10 μ F 16V 900100-25 | | CN3 | Connector 7 PIN MINI DIN (cassette) | |
| C28-C29 | Ceramic 0.1 μ F 25V 251075-06 | | | | C 251616-01 |
| C30 | Elect 10 μ F 16V 900100-25 | | CN4 | Connector 50 PIN Female Edge (exoab) | |
| C31-C32 | Ceramic 0.1 μ F 25V 251075-06 | | | | C 251630-01 |
| C33-C40 | Ceramic 0.22 μ F 25V 251075-07 | | CN5-6 | Connector 8 PIN MINI DIN (joy 1 & 2) | |
| | Sub: | | | | C 251259-01 |
| | Ceramic 0.22 μ F 50V 900022-01 | | CN7 | Connector 8 PIN DIN (audio/video) | |
| | Ceramic 0.1 μ F 50V 900020-06 | | | | 325573-01 |
| | Sub: | | CN8 | Connector 18 PIN (keyboard) | |
| | Ceramic 0.1 μ F 50V 9000010-01 | | | | C 251841-01 |
| C100 | Ceramic 0.1 μ F 50V 900010-20 | | | | |
| MISCELLANEOUS | | | L1 | Noise Filter | 251264-01 |
| Y1 | Crystal 14.31818 MHZ 251081-01 | | L2 | Line Filter | 906127-01 |
| | Sub: | | | Sub: | 251701-01 |
| Y2 | Crystal 14.31818 MHZ 251081-02 | | L3,L3 | Sub: | |
| | Crystal 1.8432 MHZ 900555-02 | | | Coil Inductor 1.2 uHpt | 901152-01 |
| SW1 | Switch, Rocker (PC Mount) | C 251587-01 | | Sub: | 325570-01 |
| SW2 | Switch, Push Button | C 251260-01 | F1 | Fuse 250V 1.5A | 903556-18 |
| M1 | RF Modulator | C 251844-01 | | Fuse Clip | 906102-01 |
| | Sub: | | | Cartridge Guide | 310171-01 |
| | RF Modulator | 251311-01 | | Shield Box | C 310172-01 |
| | | | | Shield Cap | C 310173-01 |

C — Commodore Stock Part



KEYBOARD MATRIX



7501

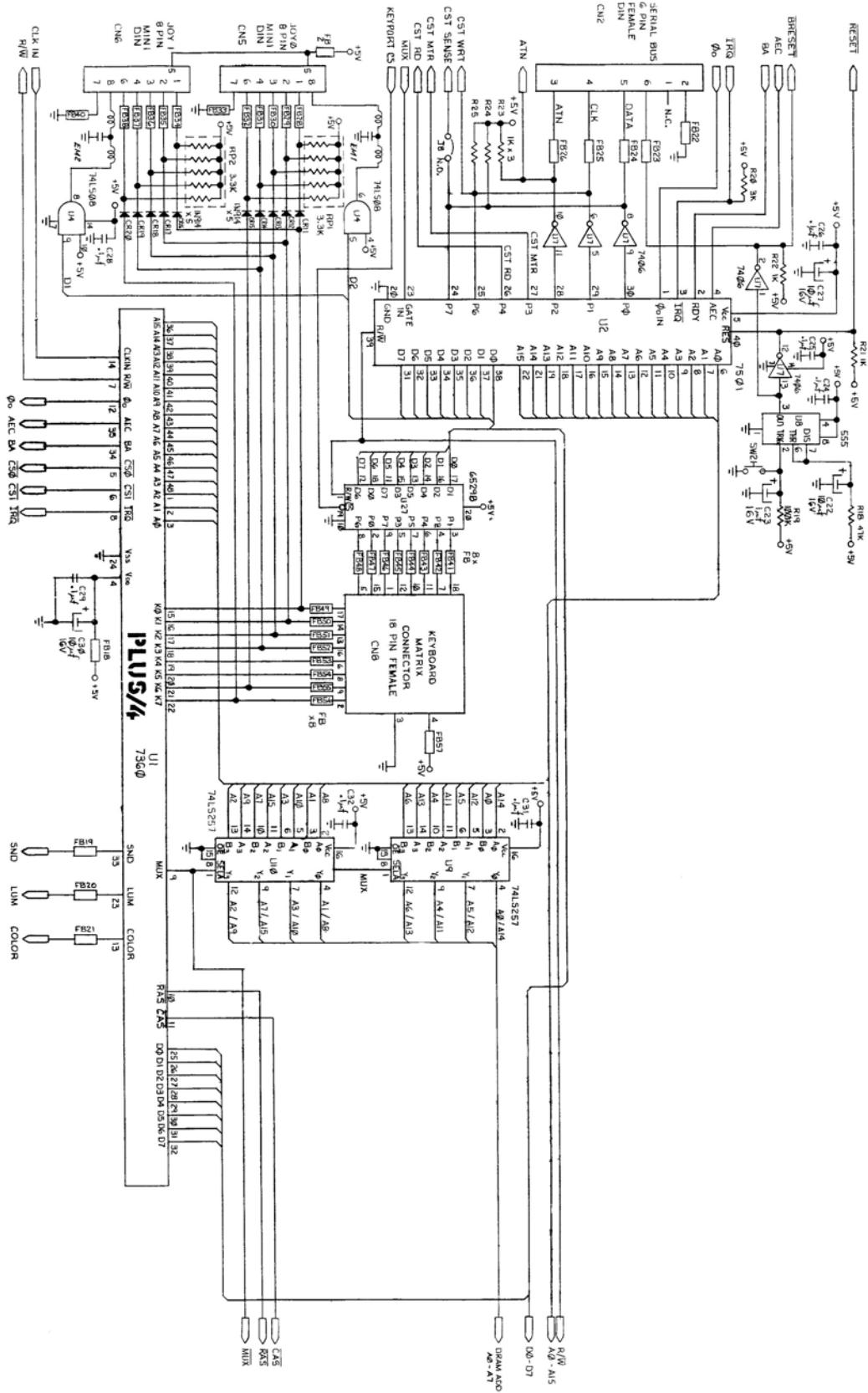
| | | | |
|------|----|----|---------|
| ϕOIN | 1 | 40 | RES |
| RDY | 2 | 39 | R/W |
| IRQ | 3 | 38 | D0 |
| AEC | 4 | 37 | D1 |
| VCC | 5 | 36 | D2 |
| A0 | 6 | 35 | D3 |
| A1 | 7 | 34 | D4 |
| A2 | 8 | 33 | D5 |
| A3 | 9 | 32 | D6 |
| A4 | 10 | 31 | D7 |
| A5 | 11 | 30 | P0 |
| A6 | 12 | 29 | P1 |
| A7 | 13 | 28 | P2 |
| A8 | 14 | 27 | P3 |
| A9 | 15 | 26 | P4 |
| A10 | 16 | 25 | P5 |
| A11 | 17 | 24 | P6 |
| A12 | 18 | 23 | GATE IN |
| A13 | 19 | 22 | A15 |
| GND | 20 | 21 | A14 |

7360

| | | | |
|--------|----|----|------|
| A2 | 1 | 48 | -A3 |
| A1 | 2 | 47 | -A4 |
| A0 | 3 | 46 | -A5 |
| VDD | 4 | 45 | -A6 |
| CS0 | 5 | 44 | -A7 |
| CS1 | 6 | 43 | -A8 |
| R/W | 7 | 42 | -A9 |
| IRQ | 8 | 41 | -A10 |
| MUX | 9 | 40 | -A11 |
| RAS | 10 | 39 | -A12 |
| CAS | 11 | 38 | -A13 |
| ϕ0 | 12 | 37 | -A14 |
| COLOR | 13 | 36 | -A15 |
| CLK IN | 14 | 35 | -AEC |
| K0 | 15 | 34 | -BA |
| K1 | 16 | 33 | -SND |
| K2 | 17 | 32 | -D7 |
| K3 | 18 | 31 | -D6 |
| K4 | 19 | 30 | -D5 |
| K5 | 20 | 29 | -D4 |
| K6 | 21 | 28 | -D3 |
| K7 | 22 | 27 | -D2 |
| SYNC | 23 | 26 | -D1 |
| VSS | 24 | 25 | -D0 |

PIN ASSIGNMENT
U2-251536-01
CUSTOM MICROPROCESSOR

PIN ASSIGNMENT
U1-251535-01
VLSI, TEXT DISPLAY
(TED)



M₁ SCHEMATIC ON PAGE 11

TRANSMIT/RECEIVE CHARACTERISTICS

| PIN CONFIGURATION | |
|------------------------------|-------------|
| VSS | 1 |
| CS0 | 2 |
| CS1 | 3 |
| RES | 4 |
| RXC | 5 |
| XTL1 | 6 |
| XTL0 | 7 |
| RTS | 8 |
| CTS | 9 |
| TXD | 10 |
| DTR | 11 |
| RXD | 12 |
| RS0 | 13 |
| RS1 | 14 |
| | 6551 |
| | 28 |
| | 27 |
| | 26 |
| | 25 |
| | 24 |
| | 23 |
| | 22 |
| | 21 |
| | 20 |
| | 19 |
| | 18 |
| | 17 |
| | 16 |
| | 15 |
| | R/W |
| | —02 |
| | IRQ |
| | D7 |
| | D6 |
| | D5 |
| | D4 |
| | D3 |
| | D2 |
| | D1 |
| | D0 |
| | DSR |
| | DCD |
| | VCC |

**U3-901895-02
ACIA**

| | | |
|-----------------|-----------------|--------------|
| SYNERTEK | SYP6551A | 2 MHZ |
|-----------------|-----------------|--------------|

| CHARACTERISTICS | SYM | —02 2 MHZ | | UNIT |
|----------------------------------|------------------|--------------|-----|------|
| | | MIN | MAX | |
| TRANSMIT/RECEIVE CLOCK RATE | t _{CCY} | * | 400 | ns |
| TRANSMIT/RECEIVE CLOCK HIGH TIME | t _{CH} | 175 | — | ns |
| TRANSMIT/RECEIVE CLOCK LOW TIME | t _{CL} | 175 | — | ns |
| XTL1 TO TXD PROPAGATION DELAY | t _{DD} | — | 500 | ns |
| RTS PROPAGATION DELAY | t _{DLY} | — | 500 | ns |
| IRQ PROPAGATION DELAY (CLEAR) | t _{IRQ} | — | 500 | ns |

(tr, tf = 10 to 30 ns)

*The Baud Rate with External Clocking is:

$$\text{BAUD RATE} = \frac{1}{16 \times T_{CCY}}$$

| PIN CONFIGURATION | |
|------------------------------|-----|
| FE | 1 |
| I7 | 2 |
| I6 | 3 |
| I5 | 4 |
| I4 | 5 |
| I3 | 6 |
| I2 | 7 |
| I1 | 8 |
| I0 | 9 |
| F7 | 10 |
| F6 | 11 |
| F5 | 12 |
| F4 | 13 |
| GND | 14 |
| | 28 |
| | 27 |
| | 26 |
| | 25 |
| | 24 |
| | 23 |
| | 22 |
| | 21 |
| | 20 |
| | 19 |
| | 18 |
| | 17 |
| | 16 |
| | 15 |
| | VCC |
| | I8 |
| | I9 |
| | I10 |
| | I11 |
| | I12 |
| | I13 |
| | I14 |
| | I15 |
| | CE |
| | F0 |
| | F1 |
| | F2 |
| | F3 |

**U19-251641-02
PLA**

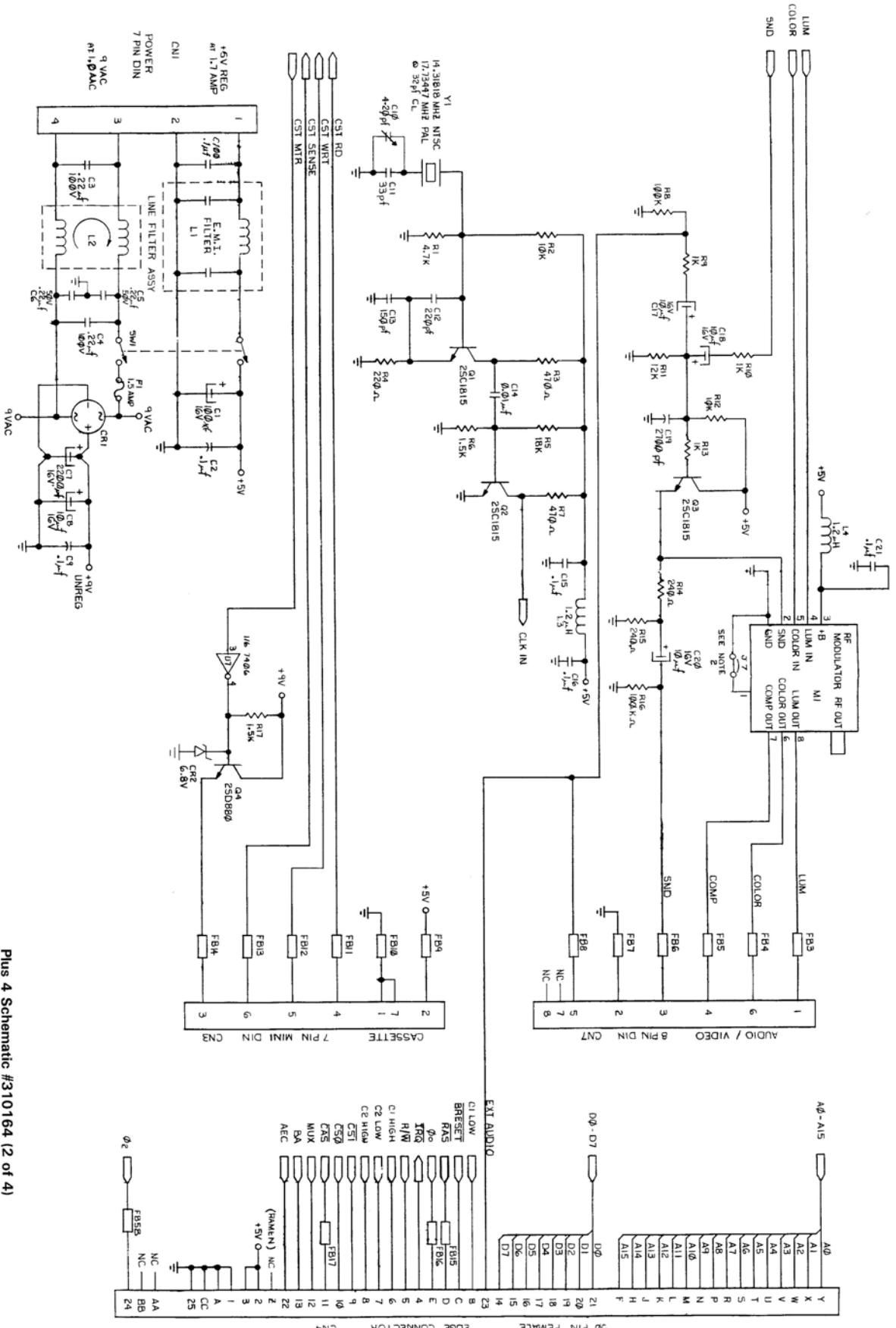
| CS | R/W | D0-D7 |
|-----------|------------|------------------|
| L | L | DATA BUS TO PORT |
| L | H | PORT TO DATA BUS |
| H | X | ISOLATION |

L = LOW LEVEL
H = HIGH LEVEL
X = IRREVELANT

| | | | |
|------------|----------|-----------|------------|
| R/W | 1 | 20 | VDD |
| P0 | 2 | 19 | CS |
| P1 | 3 | 18 | DB0 |
| P2 | 4 | 17 | DB1 |
| P3 | 5 | 16 | DB2 |
| P4 | 6 | 15 | DB3 |
| P5 | 7 | 14 | DB4 |
| P6 | 8 | 13 | DB5 |
| P7 | 9 | 12 | DB6 |
| VSS | 10 | 11 | DB7 |

| | | |
|------------|--------------|--------------|
| MOS | 6529B | 3 MHz |
|------------|--------------|--------------|

**U5/U27-251640-03
SINGLE PORT
INTERFACE**



Plus 4 Schematic #310164 (2 of 4)

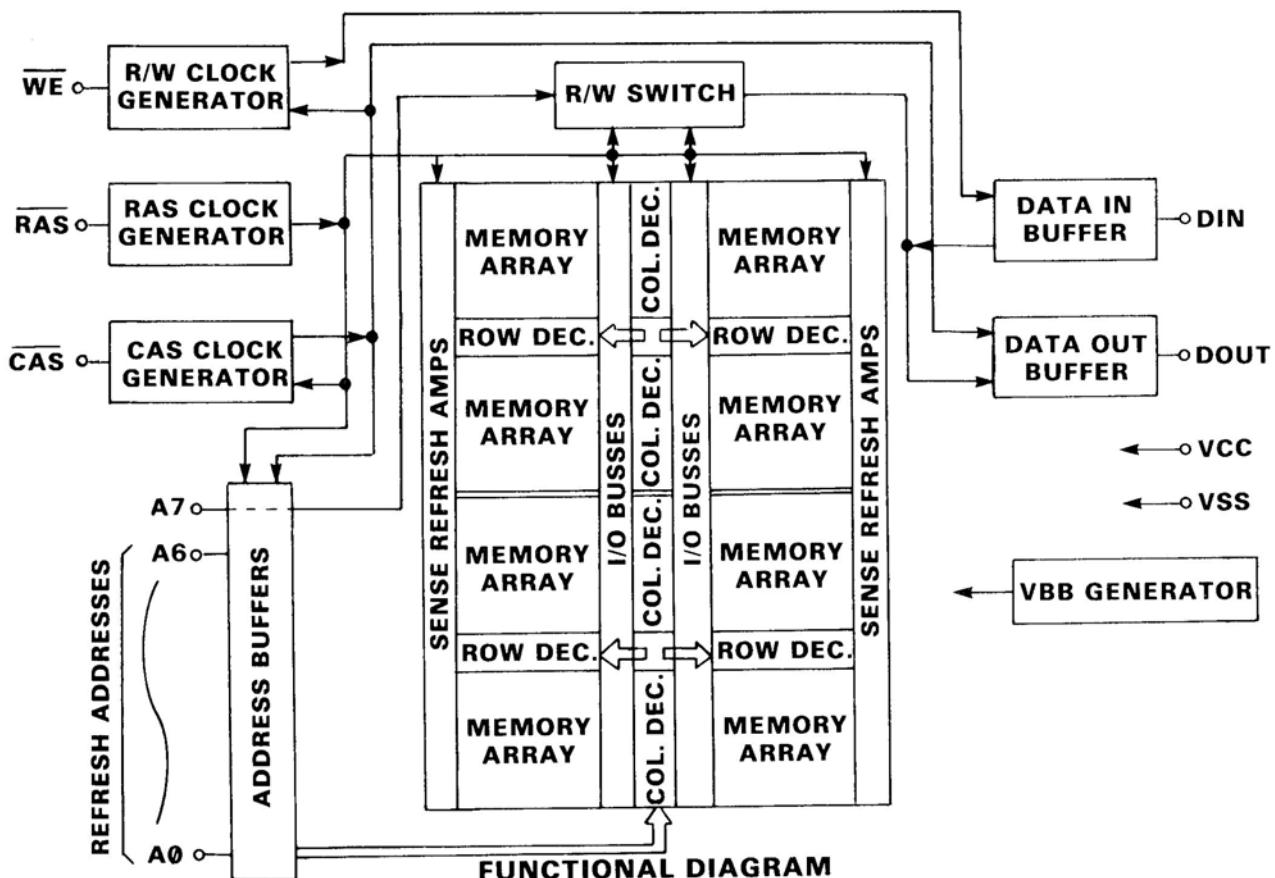
U3, U5, U19 PINOUTS ON PAGE 8

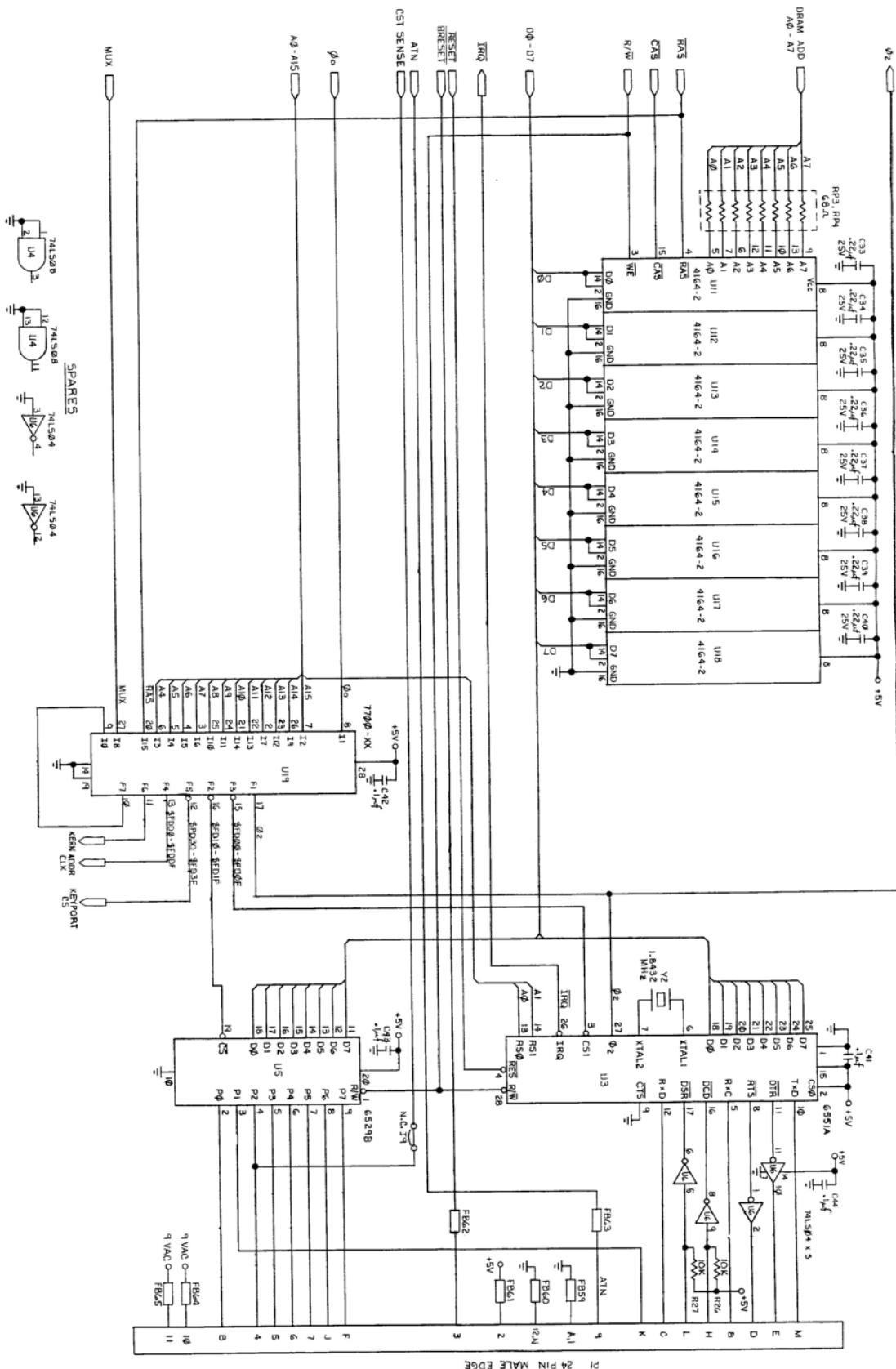
**PIN
CONFIGURATION**

| | | | |
|-----|---|----|------|
| NC | 1 | 16 | VSS |
| DIN | 2 | 15 | CAS |
| WE | 3 | 14 | DOUT |
| RAS | 4 | 13 | A6 |
| A0 | 5 | 12 | A3 |
| A2 | 6 | 11 | A4 |
| A1 | 7 | 10 | A5 |
| VCC | 8 | 9 | A7 |

**U11 ~ 18
64K DYNAMIC RAM
901505-01**

| COMMODORE PART NUMBER | APPROVED SOURCE 1 OF SUPPLY | VENDOR PART NUMBER | ACCESS TIME (ns) | CYCLES (ns) | POWER | |
|-----------------------|-----------------------------|--------------------|------------------|-------------|-------------|-------------------|
| | | | | | ACTIVE (MW) | STANDBY (MAX)(MW) |
| 901505-01 | HITACHI | HM4864-3 | 200 | 335 | 330 | 20 |
| 901505-01 | NEC | μ PD4164-2 | 200 | 375 | 250 | 28 |
| 901505-01 | MITSUBISHI | M5K416NS-20 | 200 | 330 | 275 | 28 |
| 901505-01 | MOSTEK | MK4564N-20 | 200 | 345 | 300 | 22 |
| 901505-01 | OKI | MSM3764-20 | 200 | 330 | 248 | 23 |
| 901505-01 | HITACHI | HM4864P-3 | 200 | 335 | 330 | 20 |
| 901505-01 | MATSUSHITA (PANASONIC) | MN4164P-20 | 200 | 330 | 275 | 27.5 |
| 901505-01 | SIEMENS | HYB4164-3 | 200 | 330 | 150 | 20 |
| 901505-01 | SHARP | LH2164-Z1 | 200 | 330 | 248 | 28 |
| 901505-01 | HITACHI | HM4864AP-3 | 200 | 330 | 242 | 20 |
| 901505-01 | TOSHIBA | TMM4164AP-20 | 200 | 330 | 275 | 22 |





Plus 4 Schematic #310164 (3 of 4)

**PIN
CONFIGURATION**

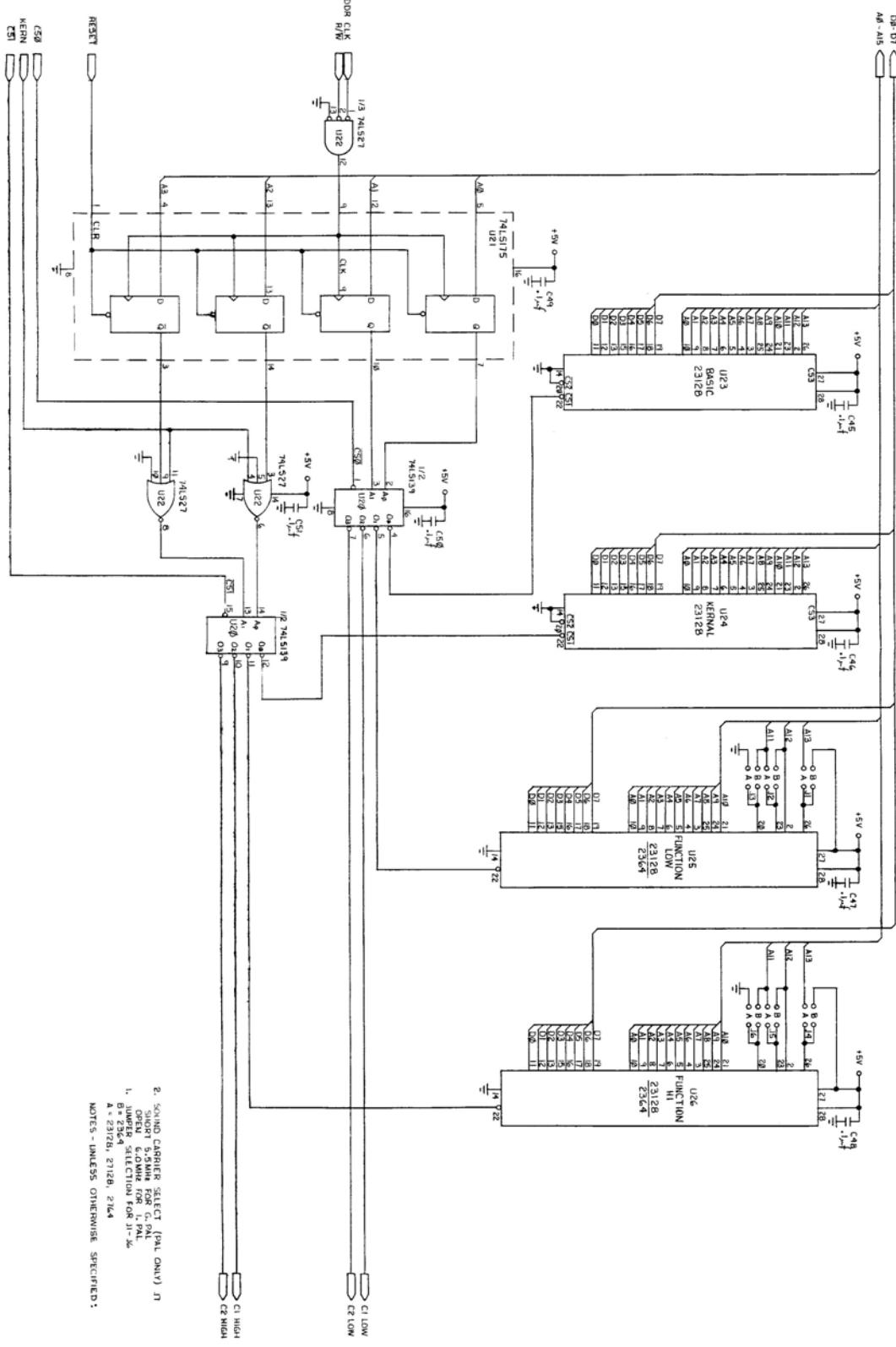
| | | | |
|-----|----|----|------------------|
| NC | 1 | 28 | -VCC |
| A12 | 2 | 27 | -CS ₃ |
| A7 | 3 | 26 | -A13 |
| A6 | 4 | 25 | -A8 |
| A5 | 5 | 24 | -A9 |
| A4 | 6 | 23 | -A11 |
| A3 | 7 | 22 | -CS ₁ |
| A2 | 8 | 21 | -A10 |
| A1 | 9 | 20 | -CS ₂ |
| A0 | 10 | 19 | -D8 |
| D1 | 11 | 18 | -D7 |
| D2 | 12 | 17 | -D6 |
| D3 | 13 | 16 | -D5 |
| GND | 14 | 15 | -D4 |

**U23-318006-01
ROM — BASIC**

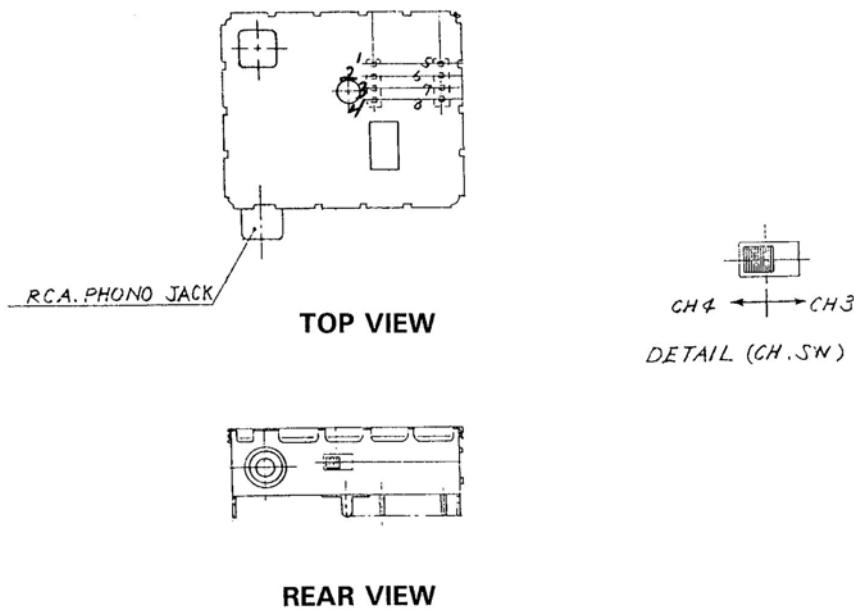
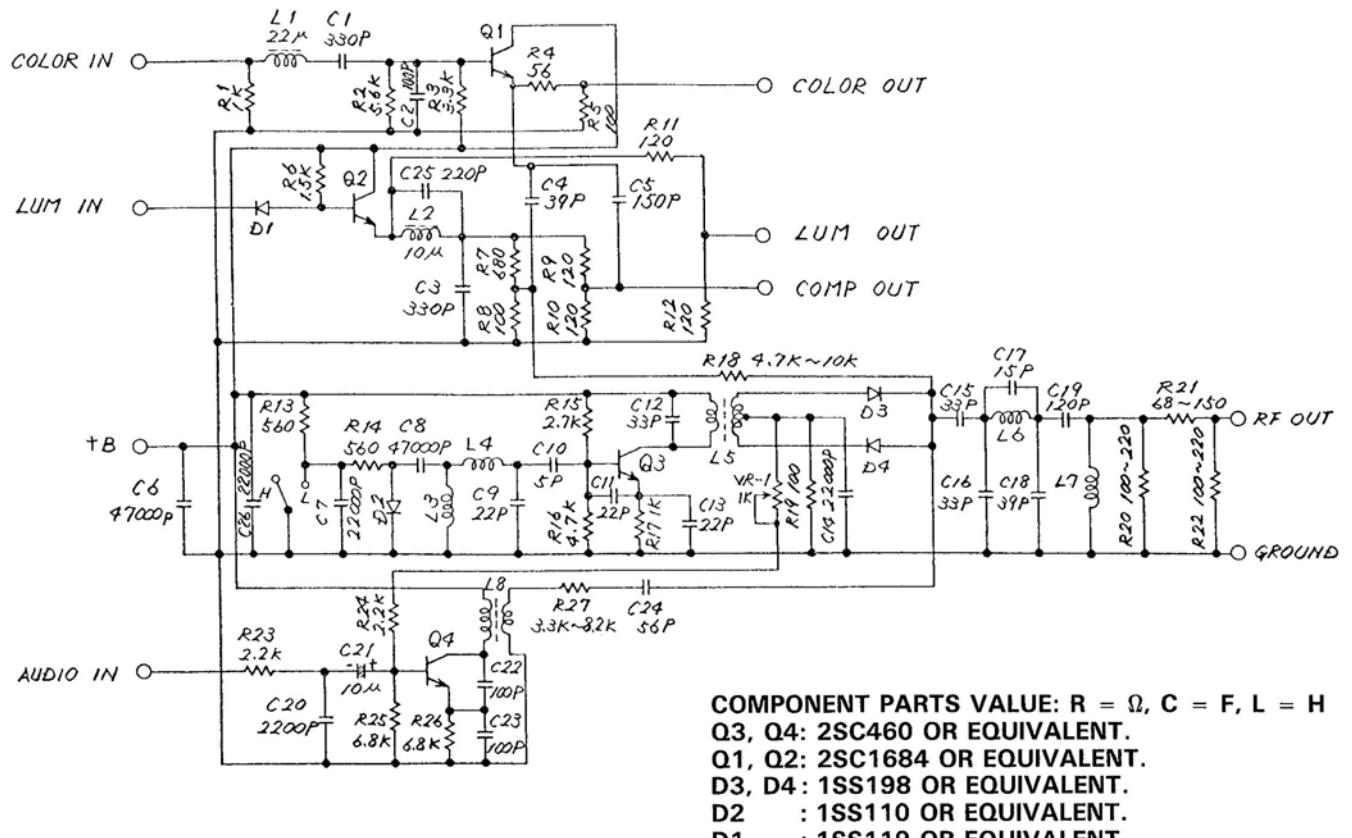
**PIN
CONFIGURATION**

| | | | |
|-----|----|----|------------------|
| NC | 1 | 28 | -VCC |
| A12 | 2 | 27 | -CS ₃ |
| A7 | 3 | 26 | -A13 |
| A6 | 4 | 25 | -A8 |
| A5 | 5 | 24 | -A9 |
| A4 | 6 | 23 | -A11 |
| A3 | 7 | 22 | -CS ₁ |
| A2 | 8 | 21 | -A10 |
| A1 | 9 | 20 | -CS ₂ |
| A0 | 10 | 19 | -D8 |
| D1 | 11 | 18 | -D7 |
| D2 | 12 | 17 | -D6 |
| D3 | 13 | 16 | -D5 |
| GND | 14 | 15 | -D4 |

**U24-318005-04
ROM — KERNEL**

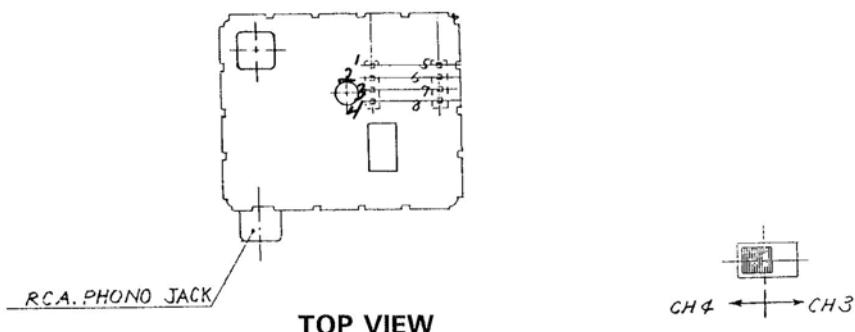
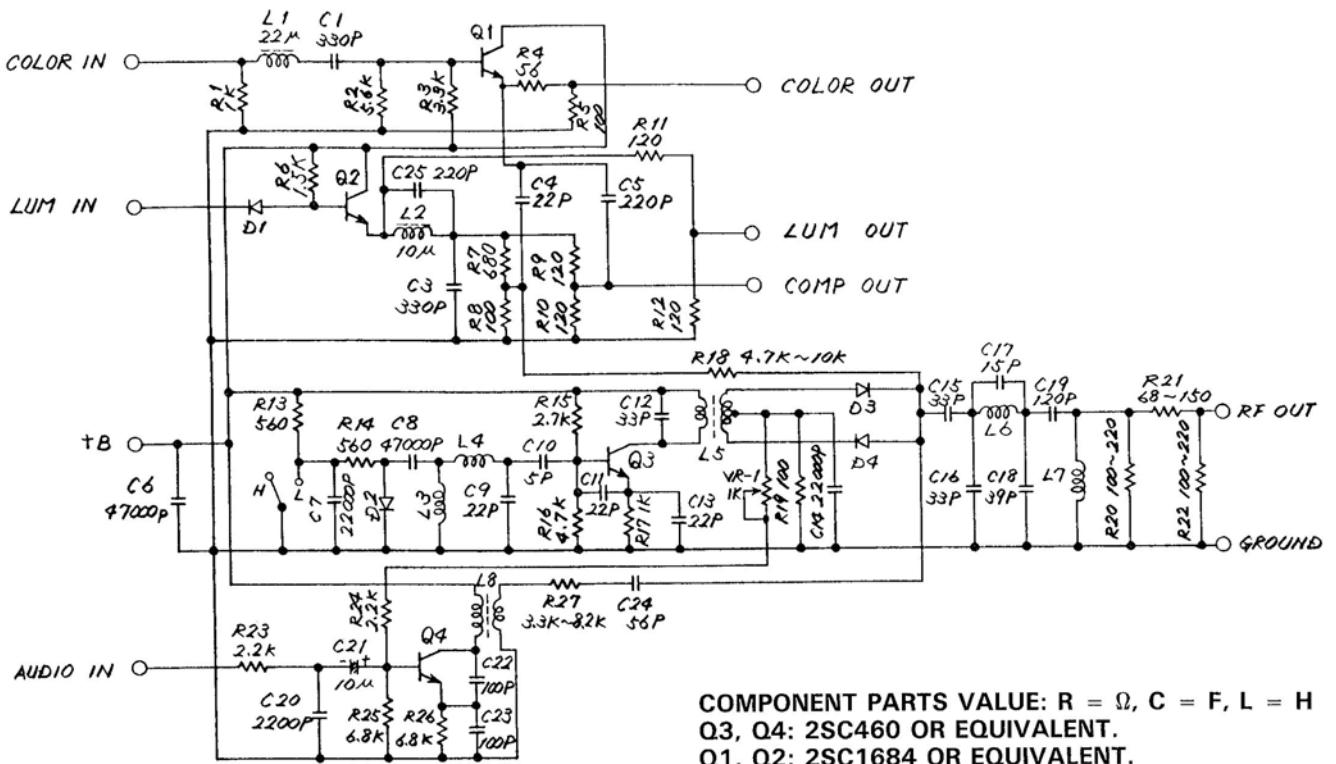


Plus 4 Schematic #310164 (4 of 4)



| NO. | TERMINALS |
|-----|-------------------------|
| 1 | N.C. |
| 2 | AUDIO SIG. INPUT |
| 3 | +B (+5V) |
| 4 | SYNC + LUM. SIG. INPUT |
| 5 | COLOR SIG. INPUT |
| 6 | COLOR SIG. OUTPUT |
| 7 | COMPO. SIG. OUTPUT |
| 8 | SYNC + LUM. SIG. OUTPUT |
| 9 | RF OUTPUT |
| 10 | CHANNEL SELECT SW. |

RF Modulator Layout and Schematic #251844



| NO. | TERMINALS |
|-----|-------------------------|
| 1 | N.C. |
| 2 | AUDIO SIG. INPUT |
| 3 | +B (+5V) |
| 4 | SYNC + LUM. SIG. INPUT |
| 5 | COLOR SIG. INPUT |
| 6 | COLOR SIG. OUTPUT |
| 7 | COMPO. SIG. OUTPUT |
| 8 | SYNC + LUM. SIG. OUTPUT |
| 9 | RF OUTPUT |
| 10 | CHANNEL SELECT SW. |

REAR VIEW

Issue 6, 1984 : Computer 3



Model: PLUS 4

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Troubleshooting Aides

NOTE: Visual inspection is critical in this unit! The upright position of many of the components used on the board can create problems. It is possible for them to be shorted to the shield or to each other. Make sure they are evenly spaced and do not contact the shield.

Areas of the PCB particularly vulnerable to this problem are:

- Bottom right corner - caps
- Bottom center - J1-J6
- Bottom left - Q3 shorted to FB57
- Top left - ferrite beads
- Center - Twisted caps (just outside of RF can)

1) NO VIDEO - Absolutely no video on screen

A) Check for 5 volts
O.K. If not: 1) Check fuse
2) Check for twisted or bent caps
 ↓
 (5 V. short to ground)
3) Check L1

B) Check for oscillation at pin 14 of U1
O.K. If not: 1) Check for good connection at
 pin 14 of U1
 ↓
 2) Check for good connection at
 R1 thru R7

C) Check for LUM signal at pin 23 of U1, at pin 4 of
the modulator, at pin 8 of the modulator, at FB3
and at pin 1 of CN7

O.K. If not: 1) Check for LUM signal shorted
 to ground
 ↓
 2) Check for open traces
3) Check modulator

D) Check for reset
O.K.
 ↓

E) Check for control signals:

| Signal | I.C. | Pin |
|--------|------|-----|
| AEC | U1 | 35 |
| AEC | U2 | 4 |
| CAS | U1 | 11 |
| CS1 | U1 | 6 |
| CS1 | U20 | 15 |
| CS0 | U1 | 5 |
| CS0 | U20 | 1 |

| Signal | I.C. | Pin |
|--------|------|-----|
| R/W | U1 | 7 |
| 0 | U1 | 12 |
| MUX | U1 | 9 |
| IRQ | U1 | 8 |
| RDY | U2 | 2 |
| BA | U1 | 34 |
| RAS | U1 | 10 |

- 2) BAD VIDEO - Scrolling lines on screen - Random blocks on screen - Blurred display
 - A) Check J1-J6 for shorts to ground or each other
O.K.
↓
 - B) Check reset for correct operation
O.K.
↓
 - C) Check U1 for proper operation
O.K. If not: 1) Check socket for good solder
↓ 2) Check for bad U1
 - D) Check U2 for proper operation
O.K. If not: 1) Check socket
↓ 2) Check for bad U2
 - E) Check RAM data lines for correct amplitude
O.K. If not: 1) Check for hot surface of RAM
↓ 2) Jump out RAM to verify
 - F) Check multiplexers U9, U10 - signals at RP3 and RP4 should be similar in frequency and amplitude
O.K. If not: 1) Suspect U9 or U10
↓
 - G) Check ROM for chip select signal at pin 22 of U23 and U24
O.K. If not: 1) Check for signal generation at U20
 - H) Check that all ROM addresses are present and correct amplitude
O.K. If not: 1) Trace problem address A0-A15
↓
 - I) Check U19, U23, U24 by replacement with known good
- 3) NO POWER
 - A) Verify voltage +5 and +9 volts
 - 1) Check for shorts to ground
 - 2) Check switch
 - 3) Check power supply
- 4) BAD BASIC - Random characters on screen - Random colors - Power-up message is missing
 - A) Check Basic ROM U23
 - B) Check B thru I above (Bad Video)

5) NO COLOR or BAD COLOR

- A) Check U1 pin 14 for 14.31818 MHz with frequency counter
O.K. If not:
 - 1) Check solder joints of CT1 and adjust for correct frequency
 - 2) Check crystal, Q1 and Q2
 - 3) Check clock circuit for opens or shorts
- B) Check U1 pin 13 for Color Out signal.
O.K. If not:
 - 1) Swap U1 w/known good
- C) Check modulator M1 pin 5 for Color In signal and pin 6 for Color Out signal
O.K. If not:
 - 1) Check M1 operation
- D) Check FB4 and CN7 pin 6 to see if color signal is present.
 - 1) Check for shorts

6) NO SOUND or BAD SOUND

- A) Check U1 pin 33 for SND signal
O.K. If not:
 - 1) Check socket for open circuit
 - 2) Swap U1 w/known good
- B) Check audio circuit for short to ground or loss of signal.
O.K. If not:
 - 1) Check Q3 - Be sure emitter and base are not shorted to 5 V.
- C) Check modulator M1 pin 2 for SND signal
 - 1) Adjust I.F. can (top right of modulator) for clean, loud volume
 - 2) M1 pin 2 to ground should read approximately 480 ohms
 - 3) Check M1 for component failure

7) SERIAL FAILURES

- A) Check FB23-26 for shorts to shield or each other
- B) Check U7, U2 and CN2

8) KEYBOARD FAILURES

- A) Check pins on ribbon cable for good connection
O.K.
↓
- B) Check for shorts - CN5, CN6, FB's, Diodes
O.K.
↓
- C) Check chip select to U27 and the I.C. U27
O.K.
↓
- D) Check U1 for proper operation
O.K. If not:
 - 1) Check socket
 - 2) Check for bad U1

9) FAILURES IN SOFTWARE MODE - All units should be checked for proper operation, when any repairs are necessary.

- To Check:
- 1) Press 'F1' on keyboard
 - 2) Press 'Return' to enter Word Processing mode
 - 3) Press 'Commodore' key and 'C' key at the same time
 - 4) Type 'tc' and press 'Return' to enter Spreadsheet
 - 5) Press 'Commodore' key and 'C' key again
 - 6) Type 'tw' to return to Word Processing mode

Watch for video or loading problems, then:

- A) Check jumpers at J1-J6 for correct connection
O.K.
↓
- B) Check U1, U2, U25, U26

Issue 7, 1984 : Computer 4



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Model: C16, PLUS 4

LINE DEFINITIONS

| | |
|-----------------|---|
| A0 to A15 | Address Bit 0 to 15 |
| AEC | Address Enable Control |
| ATN | Attention |
| BA | Bus Available |
| BRESET | Buffered System Reset |
| C1 HIGH, C1 LOW | External Cartridge Chip Select |
| C2 HIGH, C2 LOW | " |
| CAS | Dynamic RAM Column Address Strobe |
| CLK IN | Master Clock (Single Phase, 14.31818 MHz) |
| COLOR | Chroma Output |
| COMP | Composite Chroma and Luma |
| CE | Chip Enable |
| CS | Chip Select |
| CS0 | Low ROM Chip Select |
| CS1 | High ROM Chip Select |
| CST MTR | Cassette Motor Control |
| CST RD | Cassette Read |
| CST SENSE | Cassette Sensor |
| CST WRT | Cassette Write |
| CTS | Clear To Send |
| DB0 to DB7 | Data Bit 0 to 7 |
| DCD | Data Carrier Detect |
| DRAM | Dynamic RAM |
| DRAM ADD | Dynamic RAM Address |
| DSR | Data Set Ready |
| DTR | Data Terminal Ready |
| EXT AUDIO | External Audio Input |
| GATE IN | R/W GATE |
| IRQ | Interrupt Request |
| K0 to K7 | Keyboard Latch 0 to 7 |
| KERN | Kernal ROM Control Line |
| LUM | Composite Sync and Luminence |
| MUX | Address Multiplex Control |
| P0 to P7 | Port Bit 0 to 7 |
| RAS | Dynamic RAM Row Address Strobe |
| RESET | System Reset |
| RxC | Receive Clock |
| RxD | Receive Data |
| R/W | Read/Write Line |
| RTS | Request To Send |
| SND | Sound Line |
| TED | Text Display |
| TxD | Transmit Data |
| ƒ 0 | System Clock (Varies between 1 and 2 MHz) |
| ƒ 2 | Artificial ƒ 2, Address Valid Rising Edge, Data Valid Falling Edge |

Issue 6, 1985 : Computer 1
Model: C-64, C-16, Plus 4

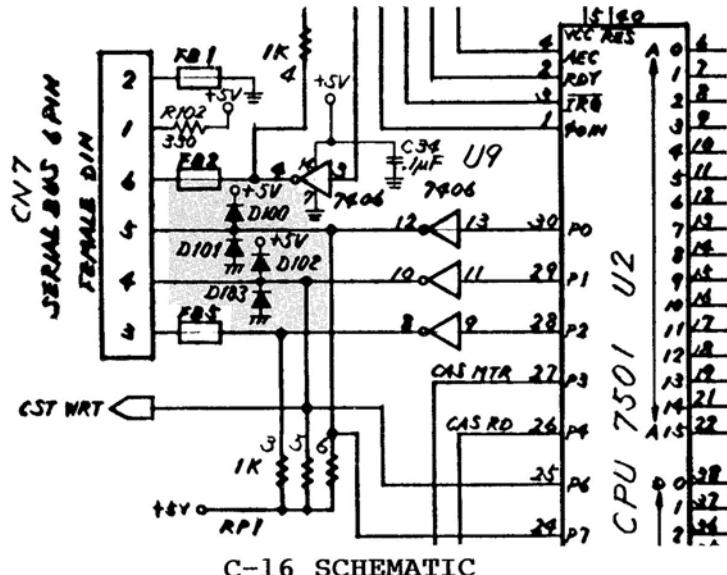


SCHEMATICS FOR C-64, C-16, PLUS 4

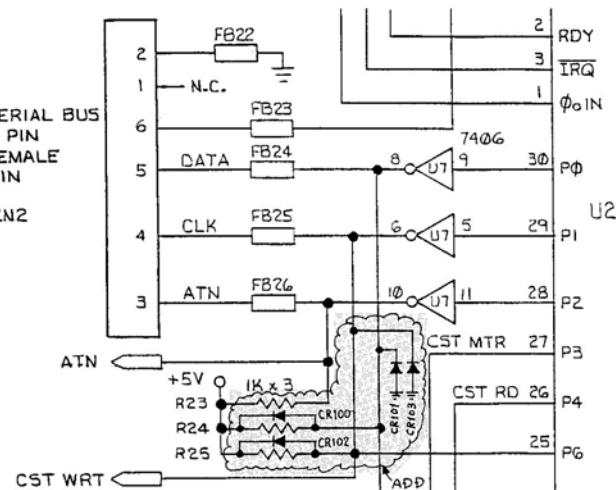
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These computers have been affected by an Engineering Change Order that adds 4 diodes to the serial port. These protection diodes are not required as field upgrades. They are 1N914s and were added as a circuit improvement.

The Schematic and PCB Layout for the C-64 in the Service Manual (Pages 28 and 32) include these diodes. However, the C-16 and Plus 4 Service Manuals were completed before the changes were made. The Schematic corrections are shown below:



C-16 SCHEMATIC



PLUS 4 SCHEMATIC